EE 201.3

(Instructors: Lynch/Teng)

Midterm Examination

Tuesday, October 25, 2005

7:00 PM

Time Allowed: 2 Hours

Materials allowed: One 8½" X 11" formula sheet, Calculators

Instructions:

- **Answer all questions in the space provided (use page backs for rough work if necessary)**
- **State your assumptions; show all relevant work. Box, circle, or otherwise highlight your answers.**
- **Put your <u>name</u> and <u>student number</u> on the cover page; put *only* your <u>student number</u> on all remaining pages.**
- **Weighting for each question is indicated in the left margin (Total marks: 100)**

2	3	4	5	6	Total
8 /15	8 /25	4 /15	20 /25	18 /20	58 /100

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Professor Lynch

#10 b) Nothing for setting up question properly (minus double the area) and received no marks

Some potentially useful constants/relationships:

Acceleration of gravity: $g = 9.81\ m/s^2$

Permeability of free space: $\mu_o = 4\pi \times 10^{-7}$ Wb/At-m

Magnetic field, B, a distance d from a wire carrying current I: $B = \frac{\mu_o I}{2\pi d}$

Magnetic force of attraction: $F_{att} = \frac{B^2 A}{2\mu_o}$

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1) Find the reluctance of a magnetic circuit if a magnetic flux $\Phi = 5.2\times10^{-4}$ Wb is established by an impressed mmf of 400 A-t.

[2] $\mathcal{F} = \mathcal{R}\Phi \qquad \mathcal{R} = \frac{\mathcal{F}}{\Phi} = \frac{400\,At}{5.2\times10^{-4}\,Wb} = 769.2\,K\frac{At}{Wb}$ 2

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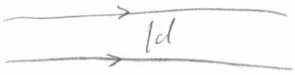
2) Two long parallel conductors, separated by a distance a = 10 cm, carry currents in the same direction. If $I_1 = 5A$ and $I_2 = 8A$, what is the force per meter unit length exerted on each conductor by the other?

[4] $B = \frac{\mu_0 I}{2\pi d} = \frac{(4\pi\times10^{-7}\frac{Wb}{Atm})(8A)}{2\pi(.10m)} = 1.6\times10^{-5}T$ ✓ 1



$F = \frac{B^2 A}{2\mu_0} = \frac{(1.6\times10^{-5}T)^2(.10m)}{2(4\pi\times10^{-7}\frac{Wb}{Atm})} = 1.0\times10^{-5}\frac{N}{m}$ 1

Wrong formula.

Do they attract or repel each other?

[1] attract ✓ 1

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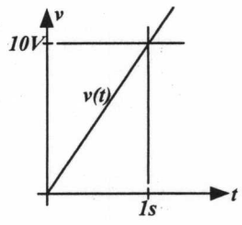
3) The voltage observed across a 1Henry inductor is shown in the diagram. Assuming the current through the inductor at $t = 0$ is 0A, what is the current through the inductor at $t = 1s$?



[4] i) 5A ii) 10A iii) 20A

$V = L\frac{\Delta i}{\Delta t} \qquad 10v = 1H\frac{\Delta i}{(1s)} \qquad \Delta t = 1s$

$di = 10A$

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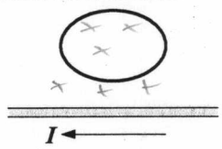
4) What is the direction of induced current in the oval loop when the current ***I*** in the wire shown below the loop decreases rapidly to zero?

[2] i) Clockwise ii) Counterclockwise 2



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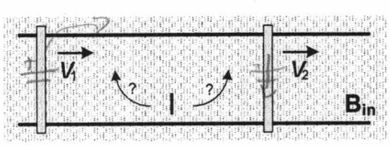
5) Two bars are moving toward right on two parallel rails. If $v_1 > v_2$, determine the direction of current in the loop (*before* the first bar catches the second bar) formed by the two bars and the rails between them.

i) Clockwise ii) Counterclockwise 2



[2]

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